



## Suitability Standards for Digital Photographic Images

This document is an attempt to provide general guidelines for selecting or preparing digital image files that might be used by Harpers Ferry Center or by parks in the production of various media. This information is technology/application dependent, and as such will change over time. In addition, this does not cover all possible situations. The perspective taken unless noted otherwise is of files being supplied to HFC for inclusion in projects we are producing. If you are working with a vendor who will be providing services to you, seek their advice. Be sure to review the **Important Details and Definitions** section that follows General Guidelines for additional information.

### General Guidelines

#### Commercial Offset Printing

Rule of thumb for resolution is 1.5 to 2 times the screen ruling being used.

##### *Coated paper (gloss or dull)*

Resolution: 300-400\* dpi  
Color Space: CMYK or grayscale  
File Type: PSD, TIFF, EPS, or PDF with no compression

##### *Uncoated paper (offset paper)*

Resolution: 200-300\* dpi  
Color Space: CMYK or grayscale  
File Type: PSD, TIFF, EPS, or PDF, JPEG high quality (little compression)

##### *Newsprint*

Resolution: 150-200\* dpi  
Color Space: CMYK or grayscale  
File Type: PSD, TIFF, EPS, or PDF, JPEG medium quality (medium compression)

#### Inkjet Printing

##### *Park wayside displays or other large display inkjet prints*

Resolution: 200\* dpi  
Color Space: RGB or grayscale  
File Type: PSD, TIFF, EPS or PDF with no compression

##### *Making highest quality photographic inkjet prints, printing on a high quality “photo grade” or “museum grade” paper, and the printer has a Postscript RIP (you are doing the printing)*

Resolution: 360-720\* dpi  
Color Space: RGB or grayscale  
File Type: TIFF, EPS or PDF with no compression

*Making highest quality photographic inkjet prints, printing on a high quality “photo grade” or “museum grade” paper, and the printer does not have a Postscript RIP (you are doing the printing)*

Resolution: 360-720\* dpi  
Color Space: RGB or grayscale  
File Type: TIFF

Note:

- Even though inkjet printers are CMYK devices they seem to do their best when RGB files are sent and the printer does the conversion. This is especially true with six color printers (CMYK + light C and light M, usually shown as CcMmYK).
- If you are using an inkjet printer as a comping device in preparing files for other media you should work according to the needs of your final end product.

### **Lambda Digital Photographic Printing**

Resolution: 200-400\* dpi (lower resolution for very large prints)  
Color Space: RGB  
File Type: TIFF if the output is only an image  
EPS if the image is placed into a page layout

### **Screen Printing and Porcelain Enamel**

Resolution: 200\* dpi  
Color Space: RGB or grayscale  
File Type: PSD, TIFF, EPS, PDF with no compression

### **Color Laser Printer with a Postscript RIP (you are doing the printing)**

Resolution: 150-200\* dpi  
Color Space: CMYK or grayscale  
File Type: TIFF or JPEG medium quality (medium compression)  
EPS or PDF are ok if the printer has a Postscript RIP

### **Internet Viewing**

Resolution: 72-100\* dpi  
Color Space: RGB or grayscale  
File Type: TIFF, PSD, PDF, GIF, or JPEG medium to low quality  
(medium to high compression)

\*For all processes the specified resolution is at the final imaged size. For more information see **resolution** below.

## Important Details and Definitions

A *digital photographic image*, as discussed here, is a raster file that is the result of a scan, a digital photograph, or that was created directly on a computer using software. It is a continuous tone image, meaning that it has shades of gray (or color). Usually the intent is to produce from this file by various means a visual representation that we would call a picture.

There are several attributes that determine the suitability of a digital photographic image for a specific use. The primary considerations are resolution, color space, and file type. Other attributes, such as contrast, color balance, and sharpening, have more to do with crafting a visually satisfying image regardless of the intended use, and are not addressed here.

An image might be used in a commercially printed publication, a publication with a small circulation that might be printed on desktop printers, a large format display such as a wayside or banner, or it might be viewed in its final form on a computer monitor. Within each of these categories may be several subcategories, each of which may have its own requirements.

While photographic images are the primary concern of this standard, there is another type of digital image that should be mentioned because its requirements are so different. It is a *bitmap* or *line* scan. Examples of this type of image are perhaps a signature or a logo. In this type of image there are no shades of gray, only black or white. Because the edges, where it goes from black to white, do not have a transitional area of gray that would dither a sawtooth edge, resolution requirements are much higher than for digital photographic images. The resolution required for this kind of image is four to eight times that required for digital photographic images in the same process.

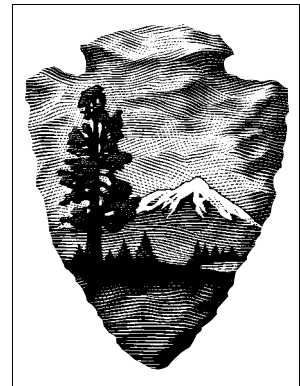
The data for both types of image are recorded as *raster data*. Raster is a data structure wherein any and every point in the image is represented by a discrete spot of information, or pixel (picture element), that describes the brightness and color of that spot. The image is made of row after row of pixels. Digital photographic images are usually described by raster data. They are never described by vector data.

By contrast *vector data* is a set of geometric instructions. A circle, for example, would be described by the x and y coordinates of its center, the radius dimension, fill, and stroke information. Since only objects are described, there is no data for vacant areas. There is a dramatic difference in the amount of data required by these two different data types. Vector files are, except in the most extreme circumstances, substantially smaller than raster files. Text, line illustrations, and flat tints are usually represented by vector data. The text in this document is an example of vector data.

Vector files, unlike raster, are resolution independent. In practice this means that you can scale vector files to whatever size you want without the image quality degrading. This is due to the fact that the resolution is determined at the point of printing when the file is RIPed.



A digital photographic image above, and a bitmap image below.



A digital photographic image above, and a bitmap image below, both enlarged 800% to show pixels.



## Resolution

Resolution is one measure of the density of information in a digital image. It is the number of samples (pixels) represented in a given physical space. The form it takes is usually dots per inch (DPI) or pixels per inch (PPI) which are the same thing. This refers to the number of samples in a specific linear distance. It is two dimensional information, data that exists on the X and Y axes. From this you can see that resolution is tied directly to physical size.

There is an inverse proportional relationship between the physical size of an image and its resolution. As you change the size of an image the resulting resolution will be inversely effected. For example, if you have a 200 dpi image at 4 x 5 inches and you double the image to 8 x 10 inches the resolution will be cut in half to 100 dpi. Likewise if you were to change the resolution to 400 dpi, the physical size will change to 2 x 2.5 inches. Even though you have the option in image editing applications to set the resolution and size independently, the net result in terms of the actual information carried by the file is always fixed.

The other expression of the density of information is bit depth. This is the amount or depth of information contained in each pixel. Bitmap images are 1 bit, that being on or off, black or white. For continuous tone images we are normally working with 8 bit images, where each pixel in each color channel can be one of 256 discrete shades. Each pixel of 16 bit data can be one of 1024 discrete shades per color channel. Think of this as the third dimension of image information, or the Z axis. This information is independent of the physical size (x and y dimensions) of the image. 12, 14, and 16 bit data is gaining support in desktop applications and can have a positive impact on the quality of images.

## Color Space

There are several ways of describing the hue, saturation, and luminance of a full color image. The two that we use regularly relate to specific methods of creating images.

*RGB* stands for Red, Green, Blue. This is an additive color process, meaning that as equal amounts of each color are added we approach white. RGB is used where light itself forms the image we view. Computer monitors and projectors are examples of RGB devices.

*CMYK* stands for Cyan, Magenta, Yellow, and Black. These are referred to as process colors. This is a subtractive color system where as equal amounts of CMY are added we approach black (theoretically). Subtractive color is used to form images where light is reflected from a surface and in the process is filtered by the ink layers that have been deposited on it. CMYK is used in commercial printing, inkjet printing and color laser printing.

All scans and digital camera images begin life in the RGB color space. Even large commercial drum scanners create RGB data, which might or might not be converted on the fly to CMYK. The RGB color space has a gamut (range of colors) that approaches what the human eye can perceive. But the possible gamut of CMYK is sharply limited by the physics of the process and includes only a portion of the possible RGB gamut.

## File Types

*PSD* (.psd), or Photoshop document, is Photoshop's native file format. It can preserve all layers, additional channels, and paths in their editable form. Few other applications can accept images in PSD format. So don't send an image.psd to someone who does not have Photoshop to open it with.

*TIFF* (.tif) stands for Tagged Image File Format. It is a good all around basic format that preserves all of the raster data. TIFF can be used without conversion in all popular page layout programs, and can be converted without loss of data to any other common file type.

*EPS* (.eps) is Encapsulated PostScript. It will preserve all of the raster and vector data like clipping paths. EPS can be used without conversion in all popular page layout programs.

*JPEG* (.jpg) is both a method of data compression for images and a file type. Because image files are raster data they tend to be large, which can be a problem for some uses of images, like on line viewing. So for these applications it is appropriate to use data compression. BUT BE AWARE, the expression "data compression" is a little misleading when it comes to images. What it amounts to is intelligently throwing away information. The more compression is applied the more visible is the deterioration. The lost data is not recoverable. Never use compression, JPEG or others, for images that must reproduce as high quality in print. When it is appropriate to use this format, save only the final, completed file as JPEG. Do not resave a JPEG file from within an application because you will throw away more data each time. If you are forwarding a file that might require more work play it safe and send a TIFF.

*PDF* (.pdf), or Portable Document Format, is a newer format that can be used in a number of ways. Images can be saved from Photoshop as PDF files which can then be viewed using Acrobat Reader. JPEG compression can also be applied in the process of saving as PDF. The same cautions mentioned under JPEG should be observed. Most page layout programs will now accept PDF files for images.